Anton Lavrik

# From 10s to 1000s of engineers:

# Scaling Erlang Developer Experience at WhatsApp

Code BEAM STO V, September 2020

# Bio

Erlang user since 2007

Built server applications in Erlang

7 years at WhatsApp

Leading WhatsApp Erlang team:

our mission: improve Erlang to make developers more productive

# Erlang at WhatsApp: 11 years of success

“best engineering decision we ever made”

https://genius.com/Jim-goetz-jim-goetz-and-jan-koum-at-startup-school-sv-2014-annotated

# Objectives

Highlight Erlang strengths: what works well

Describe our challenge of scaling Erlang DevX to larger teams and codebases

Discuss Erlang limitations and how to address them:

- static typing
- namespaces
- tools: build system, formatter, IDE integration

# Erlang strength: very efficient architecture

Highly available, more reliable than ever

Core design hasn't changed in 8 years

- Leveraging BEAM: native lightweight processes, message passing, distribution, and share-nothing memory model

Scaled extremely well:

- 2B+ users, multi-data centers, containers
- enabled multiple product features

# Erlang strength: empowers smaller teams

For example, WhatsApp scaled to 900M users with 50 engineers*

Extremely fast development cycle:

- High-level declarative language
- Fast compilation
- Fast deploys: several minutes via hotload – stateless, stateful, any # of servers

** https://www.wired.com/2015/09/whatsapp-serves-900-million-users-50-engineers/*

# What changed with growth

During startup years: move as fast as possible with a small team

- Critical: speed of iteration of 1-2 person teams, reliability of service
- Less important: code conventions, tool choice, tests, documentation

Today: rapidly growing teams, codebase, requirements

- Critical: throughput of much larger teams and orgs, reliability of service
- Now important: code conventions, tool choice, tests, documentation

*Key questions: How to provide fast development cycle with many more engineers? How important this is?*

# What we learned at Facebook

Developer productivity for larger teams becomes critical, not merely important.

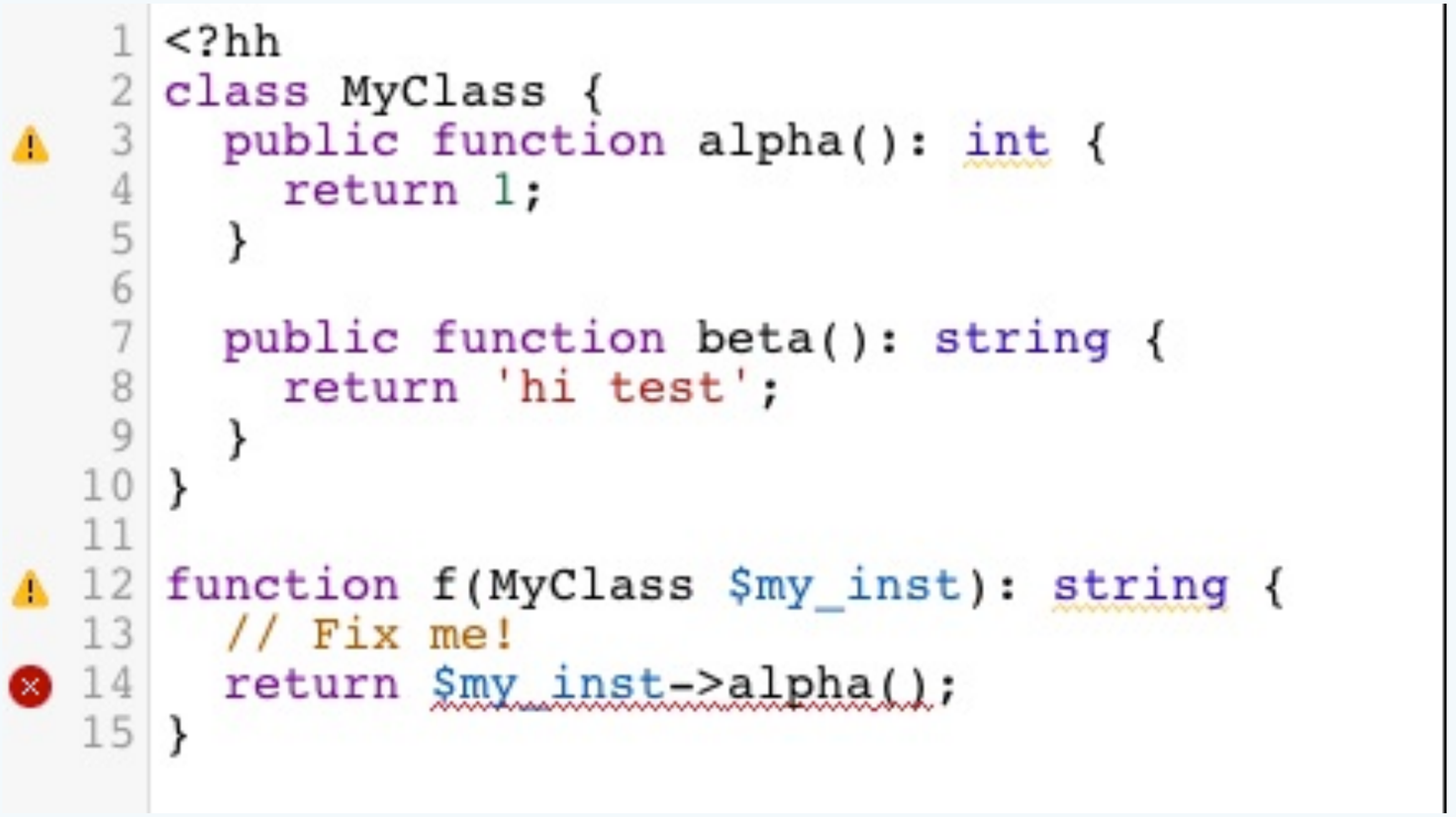
Things that help optimize development cycle matter a lot.

We have reached this phase with Erlang at WhatsApp.

Example: Hack, statically typed dialect of PHP, shows typechecker errors in the IDE interactively for 1000s of Facebook engineers since 2014*

** https://engineering.fb.com/developer-tools/hack-a-new-programming-language-for-hhvm/*

# IDE with typechecker: example from Hack




https://www.wired.com/2014/03/facebook-hack/

# Modern requirements for language DevX

- make code easy to navigate and understand
- make incremental changes reliably and efficiently
- refactor code reliably and efficiently
- promote well-structured APIs
- enable fast change-test-review-deploy workflows

A must for larger teams. But useful at any scale.

These were not requirements for Erlang when it was designed in the 90s!

# Some Erlang DevX limitations*

no static typing

flat namespace for records and modules

lack of well integrated tooling: IDE integration, formatter, build system, …

**compared to modern languages built with these requirements in mind: Go, TypeScript, Kotlin*

# Trends in languages

shift to modern languages with integrated tooling, e.g. Erlang competition:

C++, Java → Go, Rust, Kotlin

shift to static typing:

JavaScript. → TypeScript
Python → MyPy
Ruby → Sorbet
PHP → Hack

Question: what would a modern Erlang with integrated tooling and static typing look like?

# Static typing

# Static typing goals

- High productivity for teams of any sizes
- Feasible adoption for Erlang users, teams, codebases

We are working on a prototype, open-sourcing in November

# Static typing: high usability

Fast signal from typechecker

Easy to understand error messages

Integrated with language, compiler and IDE

# Good error messages: example from Elm

```
-- TYPE MISMATCH ------------------------------------- types/if-condition.elm

This condition does not evaluate to a boolean value, True or False.

3|     if List.length [0,4,1] then
          ^^^^^^^^^^^^^^^^^^^^

You have given me an condition with this type:

    Int

But I need it to be:

    Bool
```

https://elm-lang.org/news/compilers-as-assistants

# Static typing: reliable signal

Strong guarantees (aka soundness)

Consistency between code and specs

Errors on missing clauses in pattern matching

# Missing clauses: example from Elm

```
-- MISSING PATTERNS ---------------------------------------------- tmp.elm

This `case` does not have branches for all possibilities.

4|>    case list of
5|>        [x] ->
6|>            x
7|>
8|>        _ :: rest ->
9|>            last rest

You need to account for the following values:

    []

Add a branch to cover this pattern!
```

https://elm-lang.org/news/compilers-as-assistants

# Why static typing guarantees matter

reliable signal on incremental changes

reliable signal for refactoring

less tests and defensive is_* guards

# Static typing as “better Dialyzer”

highly usable

something you can rely on

doesn’t create friction

# API consistency example: option type

Wouldn’t it be great to have one way to do it?

```
% dynamically typed Erlang

undefined | T

false | {value, T}

false | T

null | T

nil | T
```

```
% Erlang with static typing

-enum option(T) ::
      some {T} | undefined.
```

# Modularity: making opaque truly opaque

```
-opaque handle() :: pid().
```

static typing answers these questions:

- how to make sure that in a large evolving codebase nobody relies on handle() being a pid()
- how to reliably make something opaque

# Declarative APIs for gen_servers

gen_server is a common building block

but! it is too loose:

- can’t easily tell what the API is
- no guarantees things don’t break on API changes, especially for dist calls

plus, we need to make it statically typed

we are prototyping a declarative and statically typed gen_server API

# Namespaces

# Problem with flat namespaces: example

Problem: Interoperability with Thrift – IDL language with namespaces*

Input .thrift file:

realtime/signaling/client_delivery/if/SignalingDelivery.thrift

Output .hrl and one of the records:

thrift_realtime_signaling_client_delivery_if_signaling_delivery.hrl

-record(signaling_delivery_signaling_delivery_service_deliver_message_to_client_result, …)

** Thrift is a cross-language RPC framework like Protocol Buffers / GRPC*

# Reasons for hierarchical namespaces

interop with other languages

structure larger codebases

enable larger open-source library ecosystems

# Tools

# Build system: rebar3

de-facto community standard

we are using it today

much faster and more robust than ever before!

but: it was not designed for larger projects and modern DevX

# Build system: new requirements

requirements for larger projects:

- large codebases
- monorepos
- multi-language support

requirements for modern DevX:

- support for static typing compilation model
- need to be very fast to expose interactive workflows in IDE

separate solutions may be needed for these

# Code formatter: erlfmt

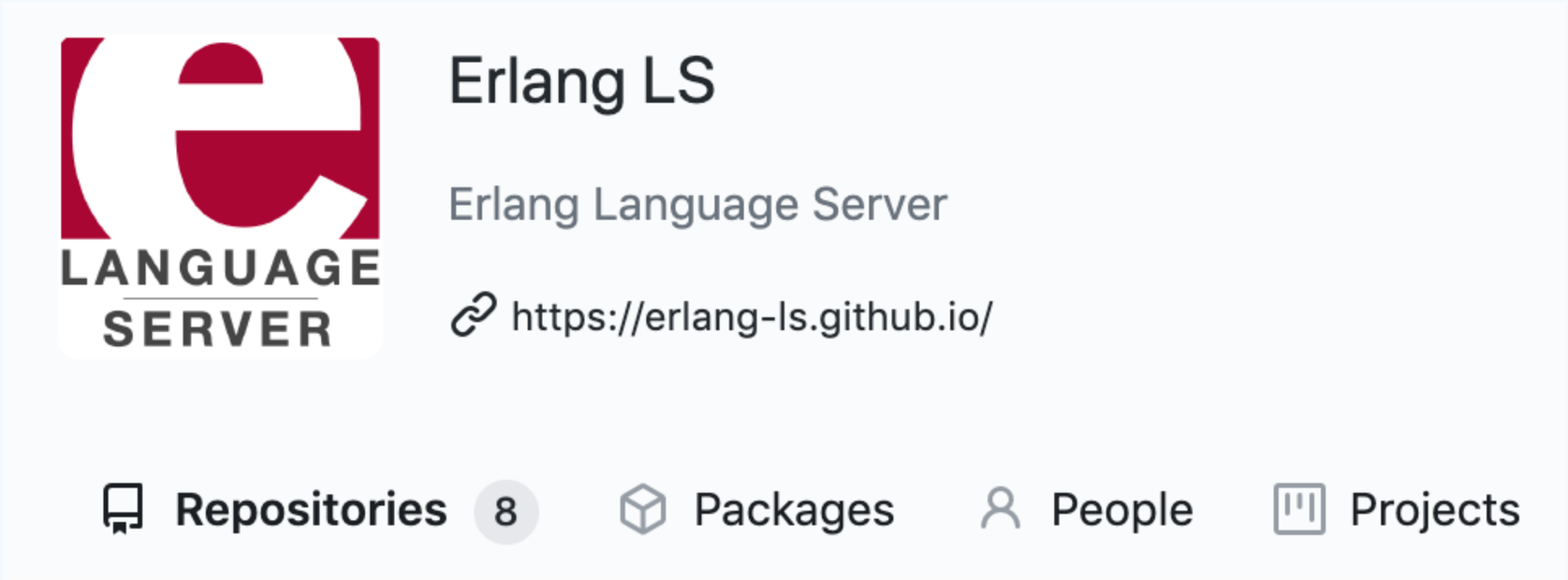
Open-source and ready for wider adoption – give it a try!
https://github.com/WhatsApp/erlfmt

Goals:

- automate formatting
- avoid style arguments in code reviews

# IDE / editor integration: erlang_ls

The time has come! Thank you, Roberto and Erlang LS contributors. Consider joining the community!



# Other exciting Erlang DevX projects at WhatsApp

testing Erlang code: ergonomic, scalable, and providing fast signal

running WhatsApp in a single BEAM instance

automated testing

automatic performance regressions detection

stay tuned for future talks!

# Conclusion: Erlang DevX can be scaled

Everyone will benefit, not only large teams

Work on static typing is underway – more details later this year

Exciting times for the Erlang community!